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(54) APPARATUS FOR DISTRIBUTING ARTICLES ARRIVING ALONG A SUPPLY PATH TO TWO DELIVERY PATHS, THE ARTICLES BEING ELONGATED IN THE DIRECTION OF THE SUPPLY PATH

(71) I, EVERHARD BAUER, a citizen of the Federal Republic of Germany, of 21 Oberer Frankfurter-Weg, 479 Paderborn, Germany, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to apparatus for distributing articles arriving along a supply path to at least two delivery paths, the articles being elongated in the direction of the supply path.

It is sometimes necessary, particularly in the packaging industry, to take articles that are ejected in a row from a machine and to assemble them in a group so that they are packaged as a group rather than individually. The articles in question may, for example, be bottles or cans that to be placed in cartons or on trays. For this purpose, the individual articles ejected by a filling machine to travel in close succession along one path are distributed to two or more juxtaposed parallel paths along which they travel to a packaging station.

In the case where the articles are circular in cross-section or have a cross-section of substantially uniform diameter, it is known to distribute the closely succeeding articles arriving along a supply path to two delivery paths with the aid of an isosceles triangular pivoted deflector having its apex pointing in the upstream direction. As an article leaves the deflector along one delivery path, it turns the deflector so that the next following article is led to the other delivery path. The known apparatus is, however, suitable for use only with single bottles, cans and other articles of substantially uniform diameter. If the articles are elongated in the direction of the supply path, for example if each article is constituted by a set of three bottles or cans ejected by the filling machine and these sets are sent in close succession along the supply path, then the triangular deflector cannot cope with the required distribution because its apex is engaged by an elongated article before the preceding article has had time to leave the deflector, which therefore becomes jammed.

Numerous attempts have been made to effect automatic distribution of elongated articles but satisfactory results have not yet been achieved.

According to the present invention, apparatus for distributing articles arriving along a supply path to two delivery paths, the articles being elongated in the direction of the supply path, comprises a conveyor effective to receive the articles and successively feed them in a line at a faster speed than at which they arrive so as to create a gap between each article received and those upstream thereof, a deflector arranged to intercept each article on the conveyor, which deflector is substantially isosceles triangular as viewed normal to the conveying surface, is arranged with its vertex directed upstream and is mounted for limited rotation about an axis that is substantially normal to the conveying surface and substantially intersects its centre of gravity and said line of feeding so that the deflector can be swung from one limiting position, at which the vertex is on one side of said line of feeding and the base faces one of the delivery paths, to the other limiting position, at which the vertex is on the other side of said line of feeding and the base faces the other delivery path, each of the equally long sides of the substantially isosceles triangular deflector being in the form of a guide member to lead a fed article to a respective delivery path after said fed article has reached said rotary axis.

The apparatus of the invention can be

[Price 33p]

operated very rapidly and therefore meets the high speed requirements of modern packaging machines.

In one form of the invention, each of the guide members formed at the sides of the deflector is spaced from an associated stationary guide so as to permit alternate fed articles to pass therebetween and effect rotation of the deflector from one limiting position to the other, rotation being limited by a fixed stop co-operating with the deflector. These stationary guides, as well as a third such guide that is preferably disposed therebetween so as to define the delivery paths on the conveyor and possibly additional stationary guides defining the supply path on the conveyor, effectively prevent the articles from leaving the fast-moving conveyor. Each stationary guide conveniently comprises two guide rails superposed at a spacing from one another so as to minimise the danger of damage to any labels on the articles. In fact many articles, such as bottles, are provided with bumper rings or collars, in which case the stationary guide rails should be disposed at the levels of these rings or collars. For the same reason, and also to enable the deflector sides to guide the articles reliably without tilting, the deflector may comprise two plates superposed at a spacing from one another, each of these plates having the aforementioned isosceles triangular shape and preferably being of plastics material so as to be able to absorb shocks.

The deflector may be fixed to a rotatable shaft carrying a lever that is directed downstream, a tension spring being provided with one end attached to the lever and its other end at a fixed location so that, when the apex of the deflector lies on the aforementioned line of feeding, the spring force is directed along a line intersecting the rotary axis of the deflector. This arrangement effectively provides a toggle mechanism for preventing uncontrolled rotation of the deflector out of either of its limiting positions. The fixed stop may be a pin engaging in a recess of the deflector. The fast-moving conveyor may comprise belts, chains or slats over which the deflector and stationary guides are disposed.

Each delivery path on the conveyor can, if desired, constitute a secondary supply path which leads to a further deflector of the aforementioned kind for distributing the articles arriving from the secondary supply path to respective secondary delivery paths. Thus, the articles arriving on the supply path may first be divided into two streams by a first deflector and then each of these two streams can be divided into further streams by the further deflectors. One problem that has not hitherto been solved but for which the present invention provides a ready solution is how to devide a single stream of articles into three streams. For this purpose, the aforementioned third stationary guides that are associated with the further deflectors need simply converge in the downstream direction to define a common secondary delivery path between each other. To enable the articles to reach the three secondary delivery paths in a precisely defined sequence, the further deflectors may be intercoupled. Preferably, each further deflector is provided with a shift arm which is rotatable therewith, the two further deflectors being juxtaposed and their shift arms being disposed to extend towards each other and overlap when the further deflectors are in one limiting rotary position. The overlapping arrangement ensures that when one further deflector is rotated by an article, the other further deflector will also be rotated if its shift arm is overlapped by that of the said one further deflector. The overlapable parts of the shift arms are preferably constructed of flat elastic material. Permanent magnets may be provided for releasably retaining the or each deflector in one of its limiting positions until rotation to the other limiting position is effected by a fed article. Such permanent magnets are particularly desirable for high speed operation where the spring toggle mechanism may give rise to vibrations.

To avoid jamming of the articles on leaving the deflector and entering the appropriate delivery path, especially in the case of articles that are only slightly longer than they are wide, for example oval cucumber jars, the guide members formed on the or each deflector may be provided with a plurality of rollers, which should be provided close to one another and with their rotary axes extending normal to the conveyor. The stationary guides may likewise provide with a plurality of rollers to minimise friction even further.

It may happen that the articles leaving the supply path are abruptly deflected by the guide members formed by the equally long sides of the triangular deflector, because the stationary guides defining the supply path and the guide members of the deflector extend at an angle to one another. The apex of the or each deflector may therefore be provided with a blunted enlargement, each side of which forms a smooth continuation of the respective stationary guide defining the supply path.

After the articles have been distributed to the delivery paths or secondary delivery paths, it may be desirable to bring all the articles in any one path closer together again. This is effected by means of retarding conveyor means which lead from the

delivery paths or secondary delivery paths. Deceleration of the articles will take place more gently if the conveying plane of the retarding conveying means extends obliquely to the conveying plane of the faster-feeding conveyor.

In the form of invention as so far described, the orientation of each article on the delivery path is the same as it was on the supply path upstream of the deflector. It may, however, sometimes be desirable for the distributed articles to be at right-angles to the position they assumed before distribution. To achieve this, instead of rotation of the deflector being effected by the fed articles, positive drive means are provided to turn the deflector to its limiting positions. The positive drive means may comprise a pneumatic or hydraulic piston-cylinder unit and the limiting position can be sensed by a photoelectric cell effective to reverse operation of the drive means. In this form of the invention, an appropriate side of the deflector is effective to turn an article through less than 90°, the turn through a right-angle being completed when the article meets a preceding article or an appropriate barrier or runs onto a retarding conveyor.

Examples of the invention will now be described with reference to the accompanying diagrammatic drawings, wherein:—

Fig. 1 is a plan view of the apparatus;

Fig. 2 is an enlarged fragmentary plan view of the Fig. 1 apparatus;

Fig. 3 is a perspective view of the Fig. 1 apparatus;

Fig. 4 is a plan view of a modified apparatus suitable for distributing articles to two delivery paths and then distributing them further to three secondary delivery paths;

Figs. 5 and 6 are fragmentary views of the Fig. 4 apparatus but showing different stages of operation;

Fig. 7 is a section on the line I-I in Fig. 6;

Fig. 8 is a fragmentary plan view of an apparatus employing a different form of deflector;

Fig. 9 is a fragmentary plan view of an apparatus employing yet another form of deflector;

Fig. 10 is an enlarged fragmentary view of the Fig. 9 apparatus and

Fig. 11 is a fragmentary plan view of a form of apparatus employing positive drive means for the deflector.

Referring to Figs. 1 to 3, articles 5 which are elongated in a supply direction 24 are in the illustrated case each represented by a set of three bottles. The articles arrive on a conveyor 1 and are received by a conveyor belt 2 which moves at twice the speed of the belt 1 and on which the articles are suitably guided along a supply path 27 by stationary guides 3, 4. Downstream of these guides a deflector 6 is pivoted by a shaft 26 about an axis that is substantially normal to the conveying surface and substantially intersects the centre of gravity of the deflector and a line 25 along which the articles from the supply path 27 are fed by the conveyor 2. The conveyor 6 is substantially isosceles triangular in plan view, i.e. as viewed normal to the conveying surface, and is arranged with its vertex directed upstream. The deflector can be swung from one limiting position, as defined by one end of a recess 30 in the deflector co-operating with a fixed stop 22, at which one limiting position the vertex is one side of the line 25, to another limiting position at which the vertex is on the other side of the line 25 and which is defined by the stop 22 engaging the other end of the recess 30, the ends of the recess being formed by shoulders 31. The fed articles 5 sweep along alternate sides of the deflector represented by the equally long sides 21 of the isosceles triangle, which sides are in the form of guide members for leading the fed article to a respective delivery path 28, 29. The base of the isosceles triangular deflector faces one or other of the delivery paths.

The fed articles 5 are led along alternate sides of the deflector because, as soon as an article has passed the rotary axis of the deflector 6, it is effective to rotate the deflector from one limiting position to the other, thereby displacing the vertex 23 of the triangle to the other side of the line 25 and ensuring that the next following article will be led to the second delivery path. After such distribution of the articles, they pass onto a retarding conveyor 12. Thus, whereas the fast-moving conveyor 2 was effective to separate the articles that may have been arriving in close succession on the conveyor 1, the retarding conveyor 12 can reduce this separation again. To minimise shocks, the plane of conveying of the conveyor 12 may be disposed at an oblique angle to that of the conveyor 2.

It should be noted that the sides 21 of the deflector 6 are not straight and their trailing or downstream ends are more curved than at the vertex so that larger accelerating forces will be exerted on the deflector 6 by each article for the purpose of rotating the deflector as it passes the rotary axis. Each guide member of the deflector formed by the side 21 is spaced from an associated stationary guide 7, 8 so as to permit alternate fed articles 5 to pass therebetween. The guides 7, 8 are continued in a downstream direction and, together with a third stationary guide 9 which is disposed therebetween and stops short of the deflector, define the delivery paths 28,

29. As will be evident from Fig. 3, each of the guides 3, 4, 7, 8 and 9 comprises two guide rails 13, 14 superposed at a spacing from one another to prevent labels on the articles from becoming damaged. The deflector 6 comprises two plates 15, 16 superposed at a spacing from one another to be disposed at the same level as the rails 13, 14. Apart from safeguarding the labels, this also ensures reliable distribution of the articles to the delivery paths without tilting. The plates 15, 16 are secured to a shaft 17 rotatable in a bushing 19 suspended from the machine frame. A lever 10 carried by the shaft 17 is directed downstream, a tension spring 11 being provided with one end attached to the downstream end of the lever 10 and its other end at a fixed location represented by the pin 18 on the frame. The arrangement is such that, when the vertex 23 of the deflector lies on the line 25 (Fig. 1) of feeding, the spring force is directed along a line intersecting the rotary axis of the deflector. This arrangement provides a toggle mechanism for biassing the deflector to one of its limiting positions and avoiding unintentionally fluttering.

Fig. 4 illustrates a form of the invention in which each delivery path 28, 29 leading from the deflector 6 constitutes a secondary supply path for the articles 5 and leads to a respective further deflector 50, 51 for distributing the articles arriving from the secondary supply path to three secondary delivery paths 56, 57 and 58. The secondary delivery path 58 is common to both deflectors 50, 51 and defined between stationary guides that converge in the downstream direction. Secured to the shaft 17 of each deflector for rotation therewith there is a shift arm 52, 53. In the position of the deflectors 50, 51 shown in Figs. 4 and 6, the apices are directed outwardly and the shift arms 52, 53 extend at right-angles to the centre line of the conveyor. Coinciding with the centre line there is a stationary guide 60 which, as previously described, may consist of two superposed guide rails and thereby enable the shift arms 52, 53 to overlap at their tips. The shift arms bring about a loose interconnection between the deflectors 50 and 51 in so far that a torque applied to one of the deflectors by a passing article is under certain conditions transmitted to the other deflector so that both deflectors will rotate in unison, as hereinafter more fully described. Fig. 7 indicates that the spring toggle mechanism may again be provided for each deflector 50, 51, the same reference numerals 19, 17, 10 and 11 being used as in Fig. 3. Fig. 7 also shows permanent magnets 59 co-operating with the levers 10 for additionally releasably holding the further deflectors 50, 51 in one of their limiting positions. The overlapable parts of the shift arms 52, 53 are constructed of flat elastic material.

The apparatus of Figs. 4 to 7 operates as follows. The article 5 in Fig. 4 passes from the delivery path 29 to sweep along the guide member 64 of the deflector 51. When the article has passed the rotary axis of the deflector, the article is effective to rotate the deflector to move into an entrance 55 for the central secondary delivery path 58. Since the shift arm 52 overlaps the shift arm 53, the deflector 50 is also rotated. Both deflectors assume the limiting position shown in Fig. 5. The next article 5*a* arrives along the secondary supply path 28 (it being recalled that the articles passing the deflector 6 enter the primary delivery paths 28 and 29 alternately). The article 5*a* sweeps along the guide member 61 of the deflector 50 and eventually rotates the latter so as to enter the outer secondary delivery path 56, the deflector 50 now being in the limiting position of Fig. 6 but the deflector 51 remaining in the position of Fig. 5. The next article 5*b* arriving along the secondary supply path 29 eventually enters the secondary delivery path 57 after having turned the deflector 51 to the Fig. 6 position. It should be noted that in Fig. 6 the shift arm 53 overlies the shift arm 52 as viewed in the downstream direction and to this extent Fig. 6 differs from Fig. 4. When yet another article 5*c* arrives along the path 28, it will be directed to the central secondary delivery path 58 after having swung the deflector 50 (and the deflector 51 through the action of the shift arms 52 and 53) to their limiting positions as shown in Fig. 5. Since the sequence in which the further deflectors 50, 51 are rotated is precisely determined, the articles will be uniformly distributed thereby amongst the three secondary delivery paths.

As shown in Fig. 8, the guide members formed at the sides 65 of the deflector 6 may be provided with a plurality of rollers 67 to minimise friction. The rollers are closely juxtaposed and mounted on axles 68 extending normal to the conveying plane. Since each deflector 6, or 50 or 51 preferably comprises two superposed plates, the roller axles can simply extend between these plates. It is also possible to provide the stationary guides with rollers.

In the embodiment of Figs. 9 and 10, the deflector 6 on shaft 26 has its vertex provided with a blunted enlargement so that the upstream end of each guide member 21 formed by the sides of the deflector can constitute a smooth continuation of the respective stationary guides 3, 4 bounding the supply path 27. As shown in Fig. 10, as an article 5 leaves the supply path, its direction is initially unchanged. Fig. 9 shows the article 5 in two different positions as it

sweeps along the deflector. It will be evident that the article moves without being subjected to shocks. The corners of the enlarged apex 69 are rounded off so that the articles will not be caught thereby.

Referring to Fig. 11, this shows a form of the invention wherein rotation of a deflector is effected by positive drive means. The fast-moving conveyor 33 receives the elongated articles 5 in the direction of the arrow 37 along the supply path 34 defined by stationary guides 35, 36. The articles successively reach alternate sides 47 of the deflector 41 which is pivoted at 43 and positively rotated by a pneumatic or hydraulic piston-cylinder unit 44 acting through a piston rod 45 that is pivoted to the deflector at 42. When an article has reached the oblique position shown at 5′, the deflector is turned to its other limiting position indicated in chain-dotted lines. The conveyor carries the partly-turned article 5′ along a respective one of the delivery paths 48, 49 defined between the stationary guides 38, 39, 40. Turning of the article through a complete 90° to the position indicated at 5″ occurs when the article strikes a preceding article or when it arrives on a retarding belt or when it strikes a suitable barrier.

In all of the embodiments, the height of the deflector in a direction normal to the conveying plane should be at least equal to the height of each article.

WHAT I CLAIM IS:—

1. Apparatus for distributing articles arriving along a supply path to two delivery paths, the articles being elongated in the direction of the supply path, comprising a conveyor effective to receive the articles and successively feed them in a line at a faster speed than that at which they arrive so as to create a gap between each article received and those upstream thereof, a deflector arranged to intercept each article on the conveyor, which deflector is substantially isosceles triangular as viewed normal to the conveying surface, is arranged with its vertex directed upstream and is mounted for limited rotation about an axis that is substantially normal to the conveying surface and substantially intersects its centre of gravity and said line of feeding so that the deflector can be swung from one limiting position, at which the vertex is on one side of said line of feeding and the base faces one of the delivery paths, to the other limiting position, at which the vertex is on the other side of said line of feeding and the base faces the other delivery path, each of the equally long sides of the substantially isosceles triangular deflector being in the form of a guide member to lead a fed article to a respective delivery path after said fed article has reached said rotary axis.

2. Apparatus according to claim 1, wherein each said guide member of the deflector is spaced from an associated stationary guide so as to permit alternate fed articles to pass therebetween and effect rotation of the deflector from one limiting position to the other, rotation being limited by a fixed stop co-operating with the deflector.

3. Apparatus according to either preceding claim, including stationary guides defining said supply path on the conveyor and stopping short of the deflector.

4. Apparatus according to claim 2 or claim 3, including a third stationary guide disposed between said stationary guides associated with the deflector so as to define the delivery paths on the conveyor, the third stationary guide stopping short of the deflector.

5. Apparatus according to any one of claims 2 to 4, wherein each stationary guide comprises two guide rails superposed at a spacing from one another.

6. Apparatus according to any preceding claim, wherein the deflector comprises two plates superposed at a spacing from one another.

7. Apparatus according to any preceding claim, wherein the deflector is fixed to a rotatable shaft carrying a lever that is directed downstream, a tension spring being provided with one end attached to the lever and its other end at a fixed location so that, when the vertex of the deflector lies on said line of feeding, the spring force is directed along a line intersecting the rotary axis of the deflector.

8. Apparatus according to any one of claims 2 to 7, wherein the fixed stop is a pin engaging in a recess of the deflector.

9. Apparatus according to any preceding claim, wherein each delivery path on the conveyor constitutes a secondary supply path and leads to a further said deflector for distributing the articles arriving from the secondary supply path to respective secondary delivery paths.

10. Apparatus according to claim 9 when appended to claim 4, wherein the third stationary guides associated with the further deflectors converge in the downstream direction to define a common secondary delivery path between each other, whereby three secondary delivery paths are provided at the downstream end of the conveyor.

11. Apparatus according to claim 10, wherein each further deflector is provided with a shift arm which is rotatable therewith, the two further deflectors being juxtaposed and their shift arms being disposed to extend towards each other and overlap

when the further deflectors are in one limiting rotary position.

12. Apparatus according to claim 11, wherein the overlapable parts of the shift arms are constructed of flat elastic material.

13. Apparatus according to any one of claims 2 to 12, including permanent magnets for releasably retaining the or each deflector in one of its limiting positions until rotation to the other limiting position is effected by a fed article.

14. Apparatus according to any preceding claim, wherein the guide members formed on the or each deflector are provided with a plurality of rollers.

15. Apparatus according to any one of claims 2 to 14, wherein the stationary guides are provided with a plurality of rollers.

16. Apparatus according to any preceding claim, wherein the vertex of the or each deflector is provided with a blunted enlargement.

17. Apparatus according to any one of claims 1 to 8, including retarding conveyor means leading from the delivery paths.

18. Apparatus according to any preceding claim when appended to claim 9, including retarding conveyor means leading from the secondary delivery paths.

19. Apparatus according to claim 17 or claim 18, wherein the conveying plane of the retarding conveying means extends obliquely to the conveying plane of said faster-feeding conveyor.

20. Apparatus according to claim 1, wherein rotation of the deflector is effected by positive drive means up to the said limiting positions.

21. Apparatus according to claim 20, wherein the drive means comprise a pneumatic or hydraulic piston-cylinder unit.

22. Apparatus according to claim 20 or claim 21, wherein the limiting position is sensed by a photoelectric cell effective to reverse operation of the drive means.

23. Distributing apparatus substantially as hereinbefore described with reference to the accompanying drawings.

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Fig. 1

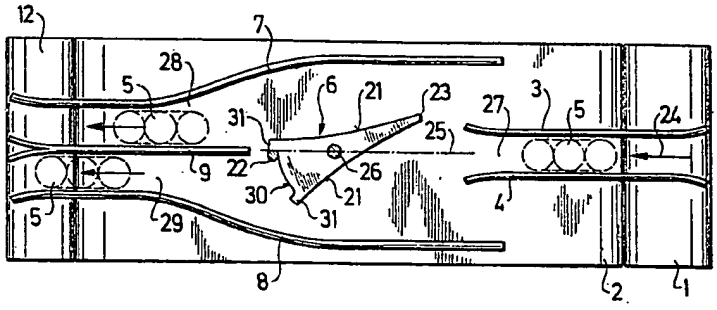
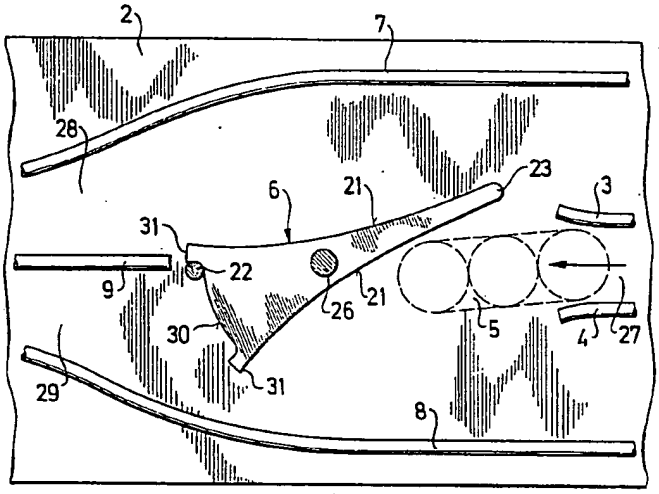


Fig. 2



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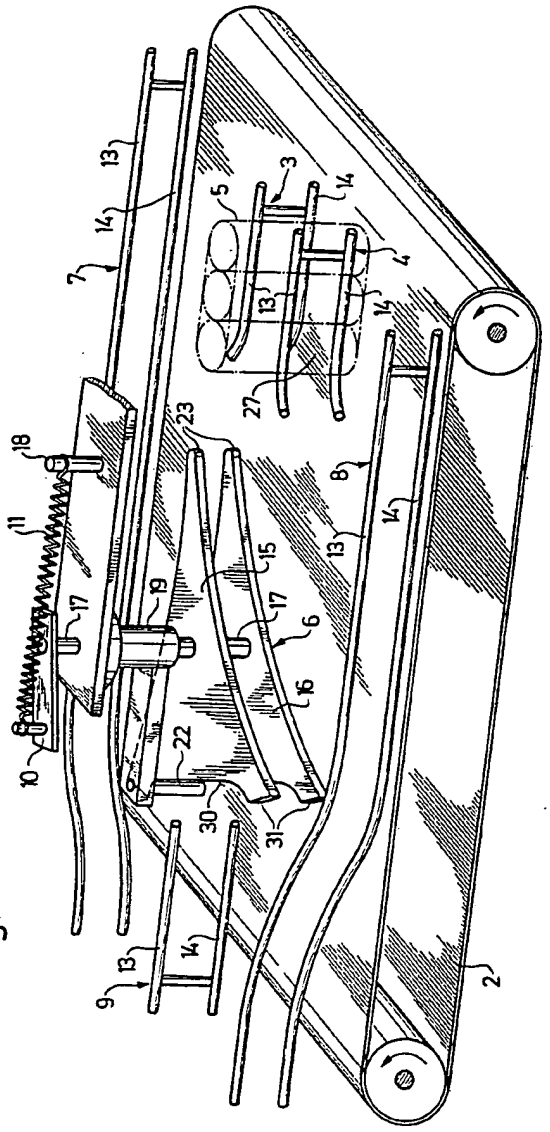

Fig. 3

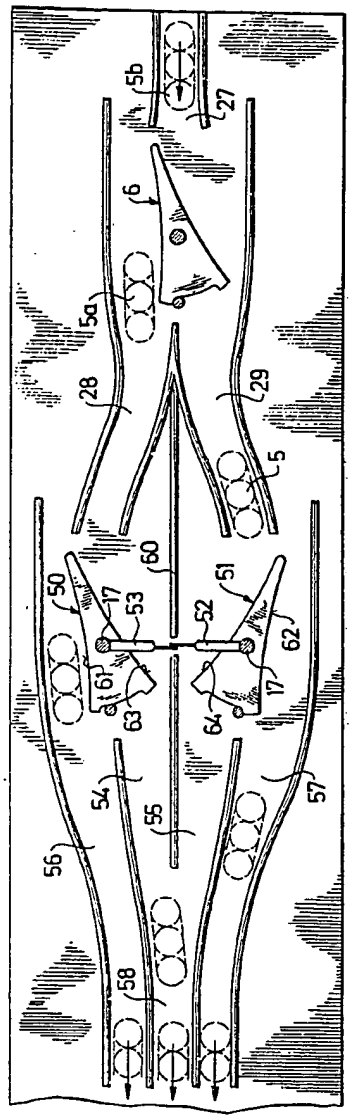

Fig. 4

Fig. 5

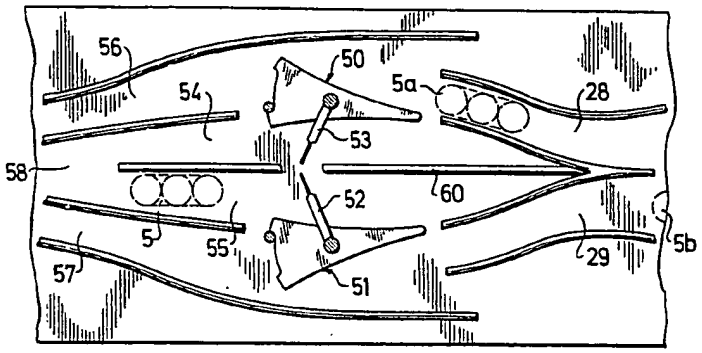

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Fig. 7

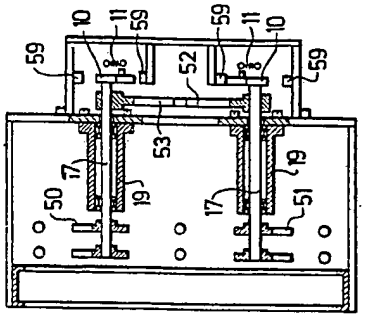

Fig. 6

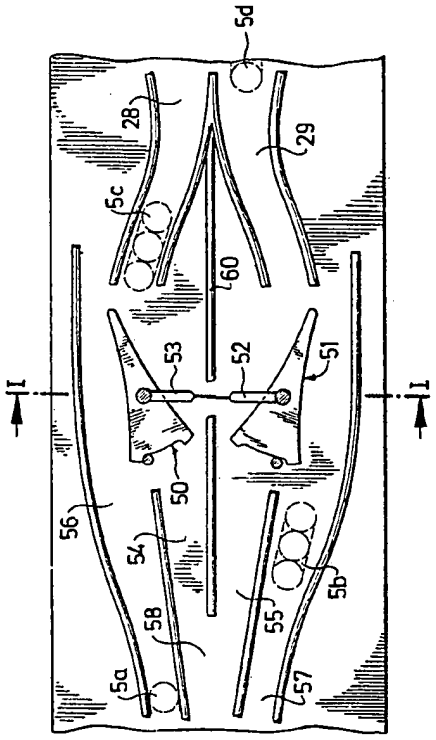

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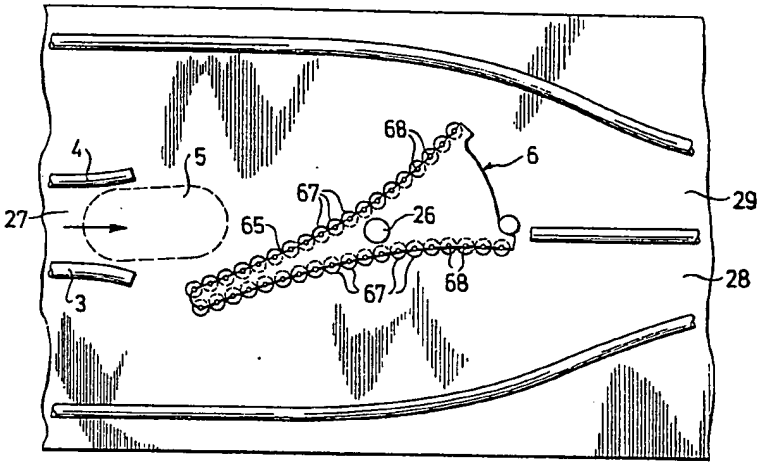
Fig. 8



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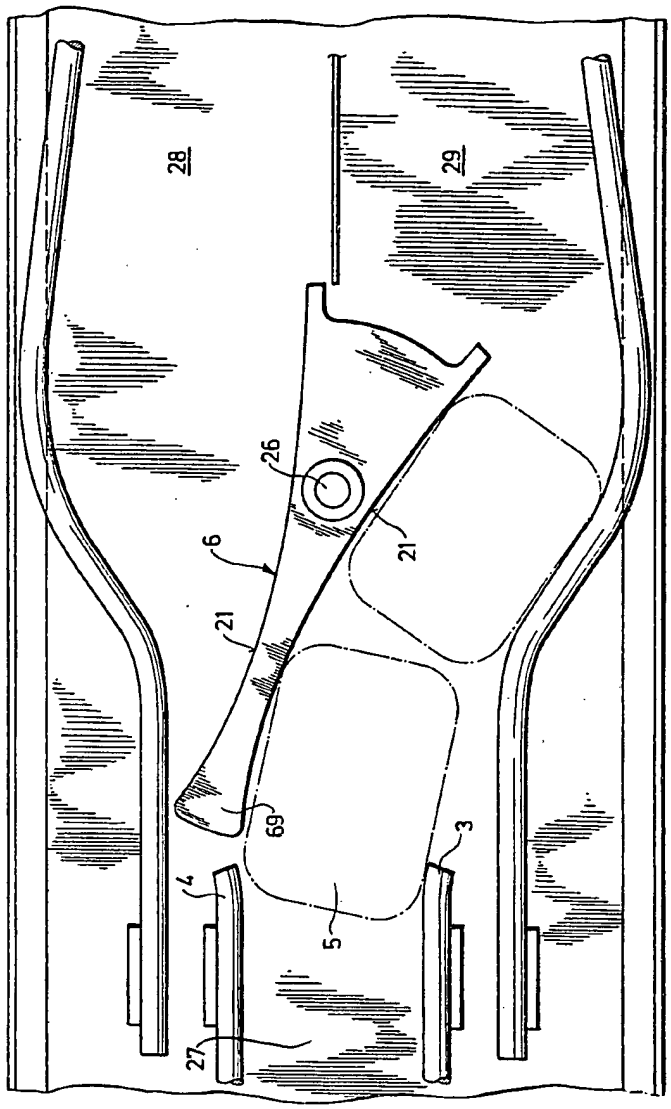

Fig. 9

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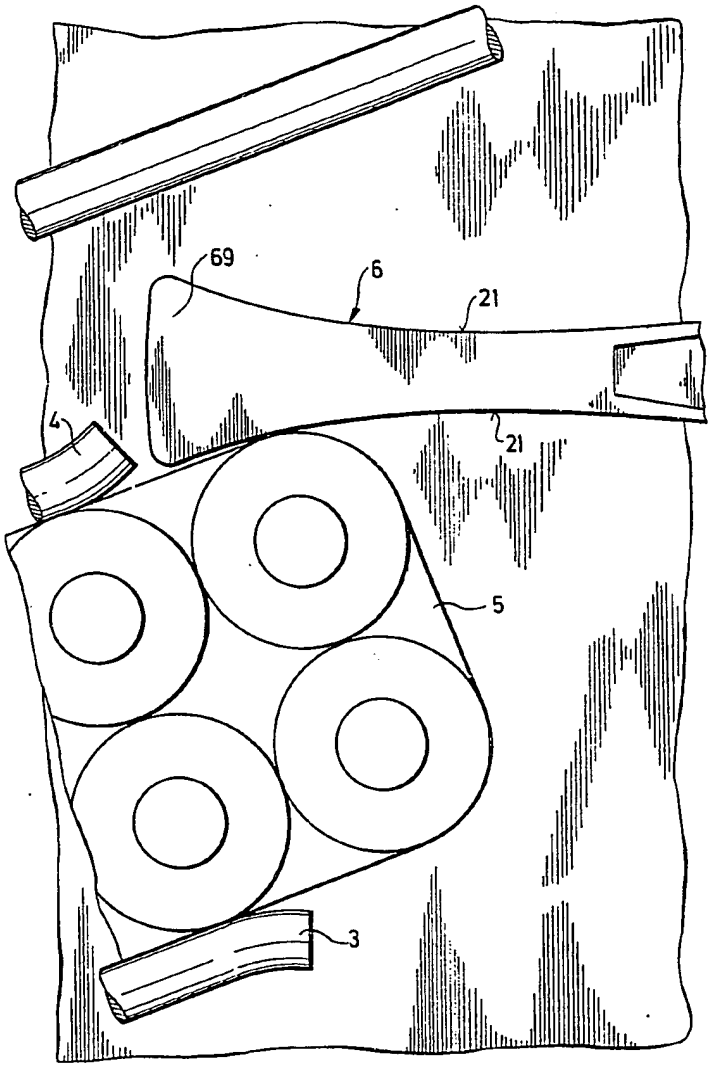
Fig. 10



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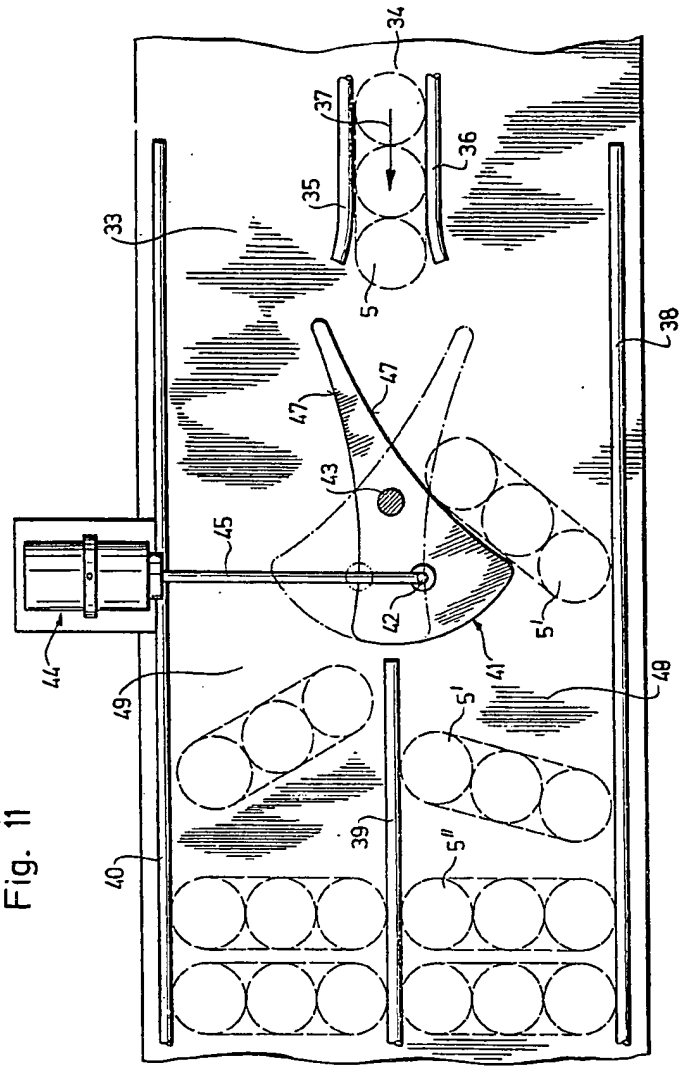

Fig. 11